SQL Server 2016 SP1 Changes The Game

Things you can do now
that were Enterprise-only before

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What we'll cover

- The game-changing alteration in SS2k16 SP1
- Editions which benefit from this change
- Features that were formerly Enterprise-only
  - Whether new in SS2k16 or new in previous releases
- Features that remain limited to some editions
- Some related changes of interest
- Ways you can check these things out for free/cheap

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The game-changing alteration

- As of SP1, <u>most features that were Enterprise-only are now available in all editions</u>
  - This includes cool new SS2k16 things, Ent-only on initial release
    - Which are now available in all or more editions as of SP1
  - But also some previous version features, Ent-only before
    - Many of which are now available in all or more editions

- We'll see over a dozen of these, many very important

- However…

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What has NOT changed?

- Note first that the capacity limits & "licensed uses" for those editions <u>have not changed</u> as of SP1
  - For instance:
    - Express still limited to 10g DBs
    - Standard still limited to 128g RAM use, and so on
    - More on these differences in a moment
- Also, there <u>do remain</u> many features which <u>ARE still limited</u> to Enterprise only, or perhaps Ent/Standard, or Ent/Std/Web
  - Most of those are about resource usage, server config/admin, etc.
- Indeed…

A new acronym for some: CPSA

- MS refers to this change as about providing a CPSA
  - Consistent (or Common) Programmability (or Programming) Surface Area
    - Stressing the portability of code among editions: more in a moment

- But even that terminology short-changes the significance
  - Some changes are indeed about features "surfaced" to developers
    - But some make available important performance-related improvements

- And we'll get to those changes, but first let's level-set some other terminology and perspectives on edition differences

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EDITIONS WHICH BENEFIT FROM THIS CHANGE

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Most know there are several editions of SQL Server

- Traditional perspective for some years has been:
  - Enterprise: commercial, full-featured, pretty much no restrictions
  - Standard: commercial, fewer features, some restrictions
  - Web: commercial, still fewer features, still more restrictions
  - Express: free, still fewer features, still more restrictions
    - Express with Advanced Services: adds Reporting Services and more
  - LocalDB (since SS2k12): free, Express-light (process, not service)
  - Trial/Eval edition: **only available as Enterprise-level functionality**
  - Developer: **also Enterprise functionality**, for development only
    - All other editions above can be used for production
- Previous editions: BI, Datacenter, Workgroup, others

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So why the change?

- Big challenge for apps built to run against Trial or Developer, then moved in prod to editions other than Enterprise (on-prem or Azure)
  - Some functionality would now <u>not</u> work
    - If leveraging programming features restricted in those editions
  - Similar challenge for ISVs/vendors creating apps deployed to all editions
- As important, many powerful performance/config features were Enterprise-only
  - Might have been compelling/useful in other editions
    - even with the capacity limits that edition may have
  - But couldn't even be "tasted" in prod, if not on Enterprise
- This change in SP1 solves both of those problems!

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OPENING THE FLOODGATES: FEATURE-BY-FEATURE CHANGES *

* The info in this section was gathered by analysis of details at
https://msdn.microsoft.com/en-us/library/cc645993.aspx
and comparing with similar details in prior releases

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Scalability and Performance

- New in SS2k16, initially Ent-only, now in all editions
  - Stretch database
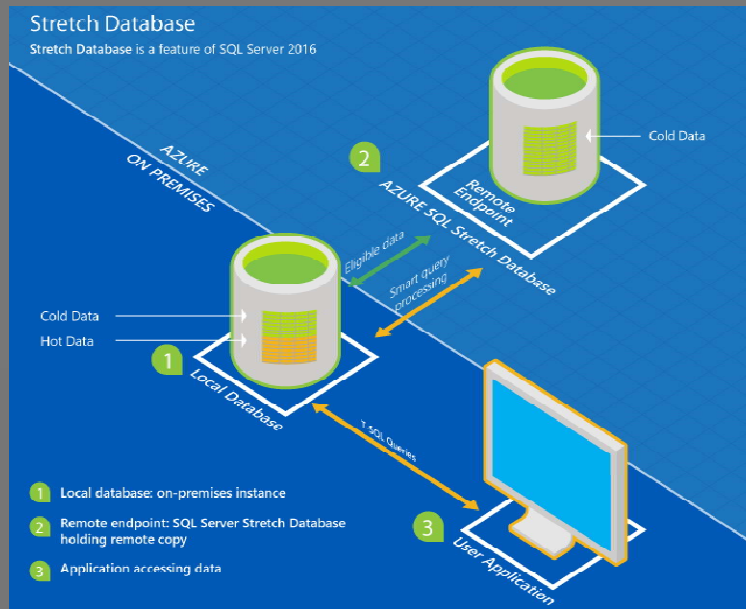
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Scalability and Performance (cont.)

- Not new in SS2k16, but formerly Ent-only, now in all editions [1]
  - In-Memory OLTP [2]
  - Columnstore indexes [2]
  - Table and index partitioning
  - Data compression
  - Multiple Filestream containers

[1] Of course, you must be using SS2k16 SP1 to leverage these features

[2] Subject to scale limits, Ent/Std/Web/Express: Unlimited/32 GB/16 GB/352 MB

Scalability and Performance
Feature Limits NOT Changed in SP1

- <u>Not</u> new in SS2k16, still Ent-only as of SP1 *
  - Resource Governor
  - Partitioned Table Parallelism
  - NUMA Aware and Large Page Memory and Buffer Array Allocation
  - IO Resource Governance

* Note: I'll NOT be listing in this talk features that are <u>not</u> new and had <u>already</u> been available in Ent/Std/Web, given focus of this talk on what <u>now</u> IS

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Security

- New in SS2k16, initially Ent-only, now in all
  - Always encrypted

Security (cont.)

- New in SS2k16, initially Ent/Std-only, now in all
  - Row-level security

  - Dynamic data masking

- <u>Not</u> new in SS2k16, formerly Ent-only, now in all
  - Fine grained (database-level) auditing

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Security Feature Limits NOT Changed

- <u>Not</u> new in SS2k16, still Ent-only
  - Transparent database encryption
  - Extensible key management
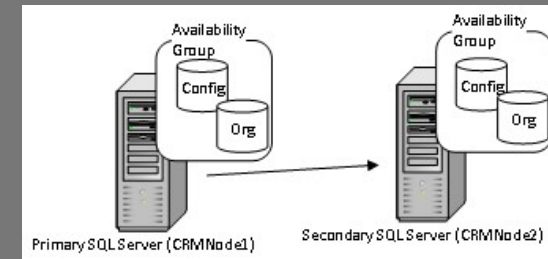- <u>Not</u> new in SS2k16, still Ent/Std-only
  - Encryption for backups

HaDr Features

- <u>Not</u> new in SS2k16, formerly Ent-only, now in all
  - Database snapshots

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HaDr Feature Limits NOT Changed

- ## New in SS2k16, only in Std

  - Always On *Basic* Availability Groups

    - Replaces deprecated Database Mirroring

    - Ent has Always On availability groups (not "basic")

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HaDr Feature Limits NOT Changed (cont.)

- <u>Not</u> new in SS2k16, <u>still</u> Ent/Std-only
  - Backup compression
  - Encrypted backup
  - Hybrid backup to Windows Azure (BACKUP "TO URL")
  - Always On failover cluster instances (still only 2 nodes in Std)
- <u>Not</u> new in SS2k16, still Ent/Std/Web-only
  - Log shipping
- <u>Not</u> new in SS2k16, still only available completely in Ent
  - Database mirroring
    - still full safety only in Std
    - still witness-only in Web/Express/LocalDB

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HaDr Feature Limits NOT Changed (cont.)

- <u>Not</u> new in SS2k16, still Ent-only
  - Always On availability groups
  - Online page and file restore, indexing, and schema change
  - Fast recovery
  - Mirrored backups
  - Hot add memory and CPU

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Replication Feature Limits NOT Changed

- New in SS2k16, still Ent/Std-only
  - Transactional replication to Azure
- <u>Not</u> new in SS2k16, still Ent/Std-only
  - Heterogeneous subscribers
  - Transactional replication updateable subscription[*]
- <u>Not</u> new in SS2k16, still Ent-only
  - Oracle publishing
  - Peer to peer transactional replication

[*] Transactional replication otherwise in all editions; subscriber-only in Web/Express/LocalDB

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Programmability

- New in SS2k16, initially Ent-only, now in all
  - Polybase compute node
    - Polybase head node is still Ent-only
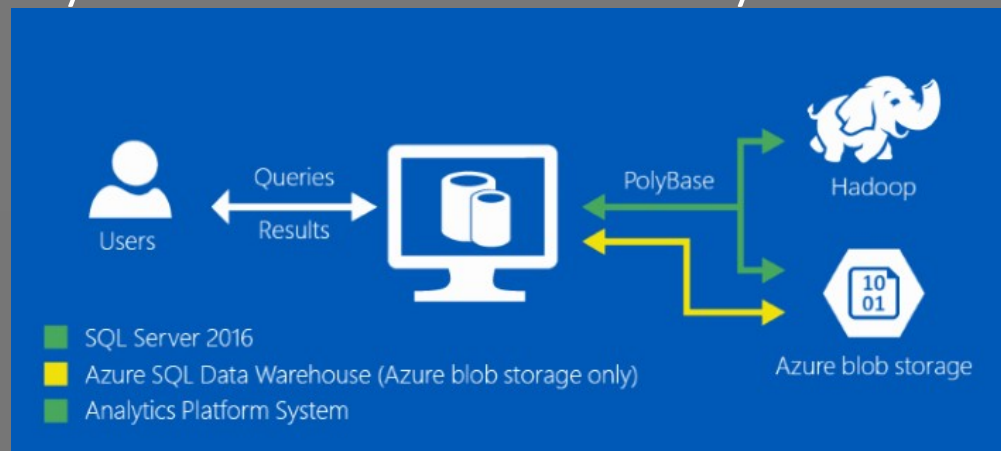
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Programmability Feature Limits NOT Changed

- New in SS2k16, already in all editions
  - Basic R integration (though in Express, only with Adv Svcs)
  - JSON
  - Query Store
  - Temporal tables
- New in SS2k16, still Ent-only
  - Advanced R integration
  - R Server (Standalone)

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Data Warehouse

- <u>Not</u> new in SS2k16, but formerly Ent-only, now in Std
  - Change data capture (CDC)
    - Different from already-existing change tracking (CT)
    - CT tracks only THAT a change was made, not the change itself
    - CDC tracks both, and keeps them historically

Feature areas unchanged *

- Analysis (Analytics/BI)
- Integration
- Manageability
- Management tools
- Development tools

- So that's it! Let's review/summarize…

* "Unchanged" meaning no change to support across editions. Many features were and remain limited to Ent-only, or Ent/Std, etc.

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Summary: Features Newly Available in All

- Always encrypted
- Columnstore indexes
- Data compression
- Database snapshots
- Dynamic data masking
- Fine grained (db-level) auditing
- In-Memory OLTP

- Multiple Filestream containers
- Persistent main memory
  - Mentioned in MS table of new features, no doc found at all
- Polybase compute node
- Row-level security
- Stretch database
- Table and index partitioning

Note: Basic R integration, JSON, Query Store, Temporal tables though new in 2k16 were already available in Std/Web/Express

Summary: Features still limited to Ent

- Advanced R integration
- Always On availability groups
- Extensible key management
- Fast recovery
- Hot add memory and CPU
- IO Resource Governance
- Mirrored backups
- NUMA Aware and Large Page Memory and Buffer Array Allocation

- Online page and file restore, indexing, and schema change
- Oracle publishing
- Partitioned Table Parallelism
- Peer to peer transactional replication
- Polybase head node
- R Server (Standalone)
- Resource Governor
- Transparent database encryption

Again: Not tracking here Analysis (Analytics, BI), Integration, Manageability, Mgt/Dev tools features, as none of the limits changed

Summary: Features still/newly limited to Ent/Std

- Always On failover cluster instances (still only 2 nodes in Std)
- Availability Groups (Basic in Std, Full in Ent)
- Backup compression
- Change data capture (CDC)
- Encrypted backup
- Encryption for backups

- Heterogeneous subscribers
- Hybrid backup to Windows Azure (BACKUP "TO URL")
- Log shipping (also in Web)
- Transactional replication to Azure
- Transactional replication updateable subscription

Again: Not tracking here Analysis (Analytics, BI), Integration, Manageability, Mgt/Dev tools features, as none of the limits changed

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Some other new SS2k16 SP1 features

- These don't vary per edition, so beyond scope, but:
  - "CREATE OR ALTER" support added to SQL DDL
  - New query optimizer OPTION argument: "Use Hint"
  - Persistent log buffer / Storage Class Memory (Win2k16)
  - Database cloning adds support for cloning CLR, Filestream/Filetable, Hekaton and Query Store objects
  - And much more
    - https://blogs.msdn.microsoft.com/sqlreleaseservices/sql-server-2016-service-pack-1-sp1-released/

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WAYS YOU CAN CHECK OUT THESE THINGS FOR FREE (OR CHEAP)

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How to check things out

- Even if SS2k16 is "not yet available where you work"
  - There are several ways you can check out these new capabilities today
- Some may be old news, some may be surprising changes
  - Links to these are provided at end of talk
  - ...

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You most likely knew about…

- Free 180-day SQL Server 2016 trial/eval
  - Again, only as Enterprise-level functionality/capacities
- Developer edition – used to be cheap, now <u>free</u>
  - This was changed originally in SS2k14
  - Again, only as Enterprise-level functionality/capacities
- Express and LocalDB editions
  - Again, free; with more capacity limits than Std, Web

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But did you know also about…

- Free 30-day trial of Azure SQL Database
  - Available in Basic, Standard, Premium, Premium RS editions
  - Features and capacities vary by edition and "performance level" chosen
- Free 2-hour virtual labs (cloud, as Enterprise)
- Free pre-packaged Docker containers (as Express)
  - For Windows or Linux
- Finally, did you know SQL Server can now run on Linux?
- Links for these and more offered in a moment

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SOME RELATED CHANGES OF INTEREST *

* Link to these are provided at end of talk

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A new sample database

- Of course, there are ample docs, and those virtual labs, and other available books/training on these new features

- But if you're wanting to explore things on your own, consider new sample database: <u>WideWorldImporters</u>

  – And also WideWorldImportersDW , for analytics/BI

- Not just an alternative to AdventureWorks (or Northwind)

  – But WWI comes pre-configured to show use of these features newly available features to users of all editions…

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WWI Support for new features [*]

- Real-time operational analytics of sales data is enabled through the use of nonclustered <u>columnstore indexes</u>

- Archive tables can be <u>stretched</u> to Azure for long-term retention, reducing storage cost and improving manageability

- <u>Query Store</u> is used to keep track of query performance

- <u>Temporal tables</u> are used to conveniently keep track of the history of reference data, as well as some of the main entities

- …

[*] From: https://blogs.technet.microsoft.com/dataplatforminsider/2016/06/09/wideworldimporters-the-new-sql-server-sample-database/

From: http://bit.ly/2oj7sGs

WWI Support for new features (cont.)

- <u>JSON</u> is used to enable AJAX calls to some of the key tables, and also to extend the relational schema to record such things as application settings and user preferences

- Advanced security features like <u>Always Encrypted</u>, <u>Row-Level Security</u> and <u>Dynamic Data Masking</u> are used to secure data

- <u>In-Memory OLTP</u> is used to optimize the performance of table-valued parameters (TVPs) and to optimize ingestion of sensor data

- <u>Clustered columnstore indexes</u> are used to reduce the storage footprint of large tables with insert-only workload

- <u>Partitioning</u> is used to improve the manageability of large tables

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New JDBC Driver

- Be aware also that if you will be leveraging SS2k16 features from Java
  - You'll want to use the latest MS SQL Server JDBC driver, version 6.0 or above
  - Is now open source, on github
    - Not to be confused with jtds.sourceforge.net

- And that's it
  - Let's wrap up with links to may resources mentioned

Links for new SS2k16 features mentioned

- Security
  - Always encrypted
    - https://msdn.microsoft.com/library/mt163865.aspx
    - **MS Video**: https://www.youtube.com/watch?v=EPIq70NzQ4k
  - Row-level security
    - https://msdn.microsoft.com/library/dn765131.aspx
    - **MS Video**: https://www.youtube.com/watch?v=Sa-kdNdWKgU
  - Data masking
    - https://msdn.microsoft.com/library/mt130841.aspx
    - **MS video**: https://www.youtube.com/watch?v=7ch8tbstkyM
  - Fine-grained auditing
    - https://docs.microsoft.com/en-us/sql/relational-databases/security/auditing/sql-server-audit-database-engine

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Links for new SS2k16 features mentioned (cont.)

- Stretch database
  - https://msdn.microsoft.com/library/dn935011.aspx
  - **MS Video**: https://www.youtube.com/watch?v=rBbkdOMx3Js
- Query store
  - https://msdn.microsoft.com/library/dn817826.aspx
  - **MS Video:** https://www.youtube.com/watch?v=HxBRjZXi3L0
- Temporal tables
  - https://msdn.microsoft.com/library/dn935015.aspx
  - **MS video**: https://www.youtube.com/watch?v=FXVjDOjNQEs
- JSON
  - https://msdn.microsoft.com/library/dn921897.aspx
  - **MS video**: https://www.youtube.com/watch?v=P5yqP72K_4s
- Change Data Capture
  - https://docs.microsoft.com/en-us/sql/relational-databases/security/encryption/always-encrypted-database-engine

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Links for new SS2k16 features mentioned (cont.)

- SQL Server R (Server and Services)
  - https://docs.microsoft.com/en-us/sql/advanced-analytics/r-services/
  - **MS video**: https://www.youtube.com/watch?v=P5yqP72K_4s
- Polybase
  - https://docs.microsoft.com/en-us/sql/relational-databases/polybase/polybase-guide
  - **MS Video:** https://www.youtube.com/watch?v=lBxSB0UY4wA
- Always On Basic Availability Groups
  - https://docs.microsoft.com/en-us/sql/database-engine/availability-groups/windows/basic-availability-groups-always-on-availability-groups
  - **MS Video**: https://www.youtube.com/watch?v=vG8H7hTNfdY
- Transactional replication to Azure
  - https://docs.microsoft.com/en-us/sql/relational-databases/replication/replication-to-sql-database

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Links for new SS2k16 features mentioned (cont.)

- Guide to licensing SS2k16 SP1 across editions
  - http://download.microsoft.com/download/9/C/6/9C6EB70A-8D52-48F4-9F04-08970411B7A3/SQL_Server_2016_Licensing_Guide_EN_US.pdf

- Of course there are links for all the features NOT new in 2016
  - Also checkout these helpful **MS videos**
    - in-memory OLTP as of 2016: https://www.youtube.com/watch?v=l5l5eophmK4
    - columnstore: https://www.youtube.com/watch?v=EB0MzVdc-ZI
    - Realtime operational analytics: https://www.youtube.com/watch?v=VgV5fbh_O-0

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Links for ways to check these out

- SS2k016 2-hour virtual labs
  - https://technet.microsoft.com/en-us/virtuallabs?id=9saV0+n59lo
- SQL Server Docker containers
  - https://hub.docker.com/r/microsoft/mssql-server-windows/
  - https://hub.docker.com/r/microsoft/mssql-server-linux/
- SQL Server on Linux
  - http://sqlserveronlinux.com

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Links for other new things I've pointed out

- WideWorldImporters sample DB
  - https://github.com/Microsoft/sql-server-samples
  - https://docs.microsoft.com/en-us/sql/sample/world-wide-importers/use-of-sql-server-features-and-capabilities-wwi-oltp
  - See also sample DB about In-memory OLTP feature
    - https://github.com/Microsoft/sql-server-samples/releases/tag/in-memory-oltp-demo-v1.0
- MS-provided SQL Server 2016 JDBC driver
  - https://docs.microsoft.com/en-us/sql/connect/jdbc/microsoft-jdbc-driver-for-sql-server
- Open source edition of JDBC driver
  - https://github.com/Microsoft/mssql-jdbc

Summary

- Key point: can do in any edition most things previously limited to Enterprise
  - So apps built in Trial/Developer Edition should work in Std, etc. or if deployed to Azure SQL DB
  - Important performance/config features previously "enterprise-only" can be leveraged in Std, etc (within any remaining capacity limits)
  - Includes features both new in SS2k16 and new but limited in previous ones
- There are many free/cheap, easy ways to get SS2k16 running to check these things out (local, cloud, docker, Linux, etc)
- …

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Summary (cont.)

- Questions on preso? charlie@carehart.org
  - Or via Twitter, FB, LinkedIn, Slack: all as carehart
    - But please don't contact me with questions <u>about USING these or other features</u>
    - Happy to consider feedback/corrections on the content
- But I certainly DO hope you're encouraged to check out SQL Server 2016 SP1 and these newly available features!
  - And enjoy the rest of the SSWUG presentations

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